

Surface contamination by hazardous drugs in two oncology inpatient units

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Background

- Studies have shown the contamination of surfaces by antineoplastic drugs in healthcare facilities, mostly in pharmacy and outpatient areas^{1,2}
- There is less data published about the contamination of patient care units

Objectives

- To measure the contamination by antineoplastic drugs on the surfaces of patient care units from two teaching hospital centers

Methods

- Two oncology inpatient units in Montreal: hospital A (move-in 1995) and hospital B (move-in October 2017)
- 36 predetermined points were sampled in each unit
- Six zones were defined: nursing pod, teaching pod, corridor, patient room, drug storage room and others
- At least one antineoplastic drug was administered within the last 24 hours in each targeted patient room:
 - Hospital A: methotrexate and cyclophosphamide
 - Hospital B: cytarabine
- Patients were present in the room during the sampling
- Cleaning of high touch surfaces was performed once a day
- Areas of 600 cm² were wiped for each sampling point
- Ten drugs were measured by UPLC-MS-MS: cyclophosphamide, cytarabine, docetaxel, fluorouracile, gemcitabine, ifosfamide, irinotecan, methotrexate, paclitaxel, vinorelbine

Results

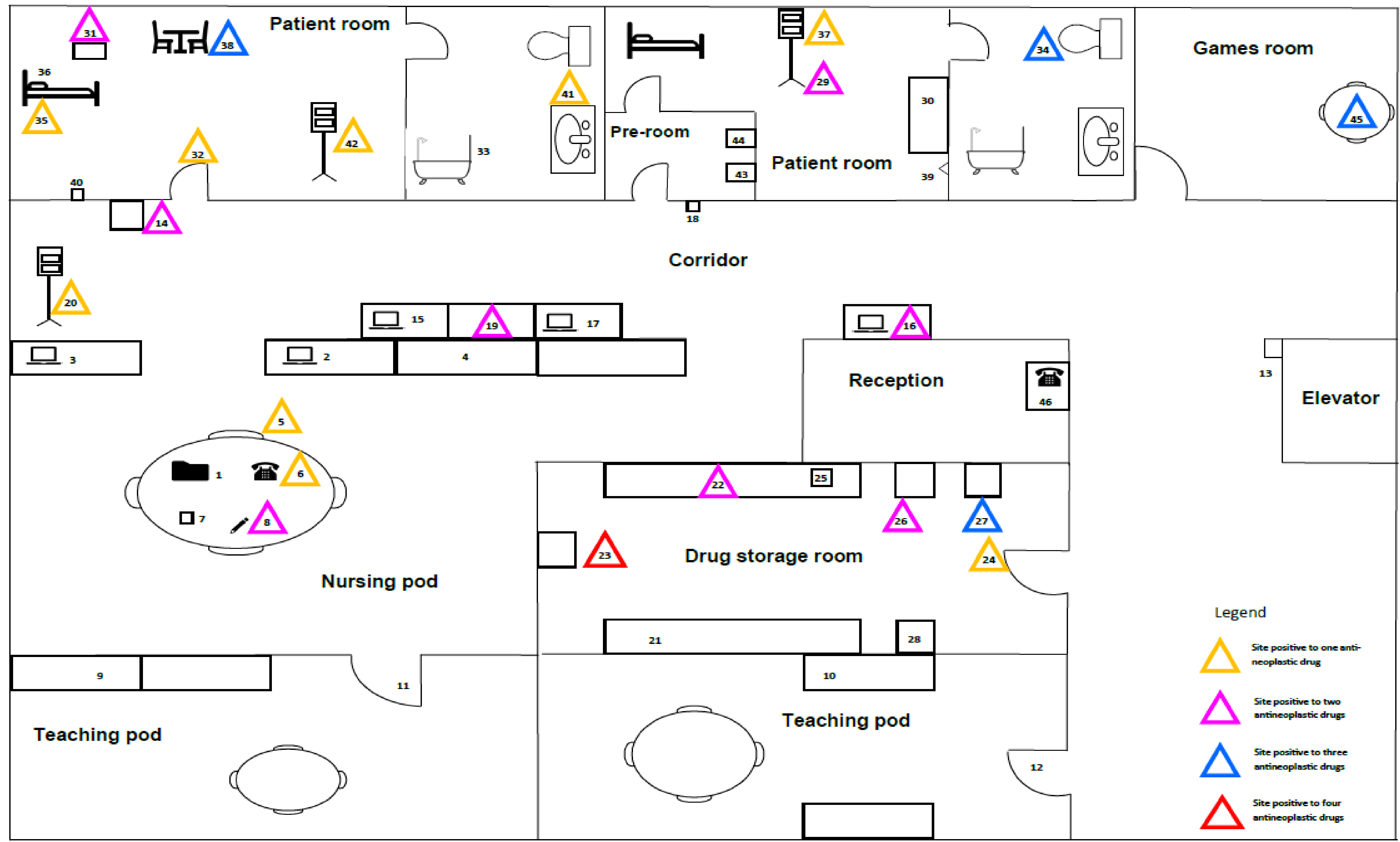


Figure 1. Visual description of surface contamination. A fictive layout of an oncology unit is represented.

Table I Contamination of surfaces in oncology units

Sampling points	Sample numbers ^a	Contamination hospital A (ng/cm ²)	Contamination hospital B (ng/cm ²)
Nursing pod			
Patient file	1	<LOD	<LOD
Keyboard	2	<LOD	<LOD
Mouse	3	<LOD	<LOD
Desk	4	<LOD	<LOD
Chair (base and armrest)	5	MTX=0.003	<LOD
Phone	6	CP=0.0017	<LOD
Employee card	7	NA	<LOD
Employee pen	8	CP=1.12, MTX=12	<LOD
Teaching pod			
Desk 1	9	<LOD	<LOD
Desk 2	10	NA	<LOD
Handle of inside door 1	11	<LOD	NA
Handle of outside door 2	12	<LOD	NA

Table I - continued

Sampling points	Sample numbers ^a	Contamination hospital A (ng/cm ²)	Contamination hospital B (ng/cm ²)
Corridor			
Elevator buttons	13	<LOD	NA
Cover of the clean cloth container ^b	14	CP=0.0017, MTX=0.001	NA
Keyboard	15	<LOD	<LOD
Mouse	16	CP=0.004, MTX=0.012	NA
Touch-screen	17	NA	<LOD
Alcoholic solution support	18	<LOD	<LOD
Surface of cart	19	CP=0.0017, MTX=0.003, CP=0.04	<LOD
Bar of the solute pole ^b	20	CP=0.0017, MTX=0.003, CP=0.04	NA
Drug storage room			
Work surface-1	21	<LOD	<LOD
Work surface-2 ^b	22	CP = 0.007, MTX = 0.028	NA
Refrigerator handle	23	CP=0.026, IRI=0.028, MTX=0.026, VRB=presence	<LOD
Handle of inside door	24	MTX = 0.006	<LOD
Calculator	25	<LOD	NA
Cytotoxic drug storage bin	26	NA	CYT=0.02, MTX=0.003
Cover of the hazardous drug bin ^b	27	CP=0.005, IRI=0.005, MTX=0.003	NA
Drug storage drawer	28	<LOD	<LOD

Table I - continued

Sampling points	Sample numbers ^a	Contamination hospital A (ng/cm ²)	Contamination hospital B (ng/cm ²)
Patient room			
Floor under the solute pool	29	NA	CP=0.0017, CYT=0.147
Work surface ^b	30	NA	<LOD
Gown crochot	31	NA	<LOD
Handle of inside door	32	MTX=0.19	<LOD
Support shower bar	33	<LOD	<LOD
Pump	34	CP=0.012	<LOD
Safety bar bed and remote	35	MTX = 0.003	CP=0.0053
Mattress	36	<LOD	<LOD
Bar of the solute pole ^b	37	NA	CYT=0.020
Chair (base and armrest)	38	CP=0.040, IF=0.023, MTX=0.2	<LOD
Mobile table	39	CP=0.031, MTX=0.011	CP=0.0017, CYT=0.040
Main switch	40	<LOD	<LOD
Tap	41	<LOD	CYT=0.040
Toilet base	42	CP=0.83, IF=0.04, MTX=0.35	CYT=0.13
Others			
Pre-room - Cover of the hazardous drug bin ^b	43	NA	<LOD
Pre-room - Cover of the clean cloth container ^b	44	NA	<LOD
Games room - Table	45	CP=0.014, IF=0.013, MTX=0.003	NA
Reception desk - Phone	46	<LOD	<LOD

^a Corresponding number in Figure 1 ; ^b Same point samples but not in the same location according to the hospitals
 LOD: Limit of detection ; CP: cyclophosphamide; CYT: cytarabine; IF: ifosfamide; IRI: irinotecan; MTX: methotrexate; VRB: vinorelbine
 LOD (ng/cm²): Cyclophosphamide = 0.0010; Cytarabine = 0.024; Docetaxel = 0.30; 5-Fluorouracile = 0.04; Gemcitabine = 0.001; Ifosfamide = 0.004; Irinotecan = 0.003; Methotrexate = 0.002; Paclitaxel = 0.04; Vinorelbine = 0.01

Discussion / Conclusion

- One third of surfaces were contaminated with at least one antineoplastic drug.
- Patient rooms were the area the most contaminated. This suggests that patients under treatment with an antineoplastic drug are a principal source of contamination, probably via their excreta.
- Healthcare workers should always wear the proper personal protective equipment and procede with hand hygiene with soap and water before and after caring for a patient, in order to remove the drug traces on their hands.
- It is questionable whether the actual cleaning of high touch surfaces should be reinforced to minimize the surface contaminations in the patient's room, while the patients are hospitalized .
- The importance of educating patients and their families on safe handling, waste management and biological fluids is crucial in the reduction of surface contamination with antineoplastic drugs.

References: 1. NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings, 2016. 2. Chauchat L, Tanguay C, Caron N, et al. Surface contamination with ten antineoplastic drugs in 83 Canadian centers. *Journal of Oncology Pharmacy Practice* 2018